Managing Wastewater from Fracking, with Robert B. Jackson

Ashley Ahearn

Hydraulic fracturing ("fracking") is a controversial practice used in natural-gas drilling. Fracking makes it much more feasible to free the vast reserves of natural gas locked underground, but the practice comes with concerns that the natural gas boom is proceeding too fast, before we understand the human health impacts. Discussions about fracking and community health typically involve questions about methane contamination of drinking water wells around drill sites. In this podcast, host Ashley Ahearn talks with Robert B. Jackson about another fracking-related water concern: the millions of gallons of contaminated wastewater generated by the process.

AHEARN: It's *The Researcher's Perspective*. I'm Ashley Ahearn.

Nearly 2 quadrillion cubic feet of natural gas is estimated to lie beneath the surface of the United States.[1] Extracting that gas becomes a lot more feasible when a process called hydraulic fracturing, or "fracking," is used.[2] In fact, natural gas may soon overtake coal as the second highest-demand fuel behind oil.[3]

But with fracking comes the potential for environmental health risks—and concerns that the natural gas boom is proceeding too fast, before we really understand the impacts of fracking.

Joining me now is Dr. Rob Jackson. He's a professor in the Nicholas School of the Environment at Duke University. He recently coauthored papers examining drinking-water quality with natural-gas extraction and interactions with policy and human health.[4]

Dr. Jackson, thanks for joining me.

JACKSON: Thank you, Ashley.

AHEARN: Tell me, how widespread is fracking? Where is it happening?

JACKSON: Well, it's widespread—it's all across the country now. It began in Texas near the Dallas–Fort Worth area, an area called the Barnett Shale. It spread to Louisiana. It's used in Colorado, Wyoming, used for oil in North Dakota and extensively in the area where I and our group here at Duke has worked, and that's the Marcellus [Shale] in Pennsylvania, New York, Ohio, and West Virginia.

AHEARN: Talk me through how fracking works. You start by drilling down into these shale formations, right?

JACKSON: That's right. Fracking has become a catch[all] term for the process of gas extraction in general; really, it's only one step. So to extract gas from shale and other rocks—and that gas is locked away in very small pores—you've got to get the gas out. You have to free the gas. So companies drill down, often a mile or more. They drill sideways through a shale layer that might be only a hundred or a couple hundred feet thick. And once they've drilled out sideways a mile or two, then they'll pump water, sand, and chemicals underground at very high pressure to crack open that rock and free

the gas. That step, literally, is the step of fracking. So hydraulic fracturing means using water to fracture the rock to allow the gas to flow to the surface.

AHEARN: Methane makes up more than 90% of the shale gas. What do we know about methane's impacts on human health?

JACKSON: Well, methane isn't regulated in our drinking water. The primary concerns for methane historically have been in cases where it can build up in the air—mines, for example. So where you have high concentrations of methane you can have an explosion, and the other risk would be for concentrations of methane to build up in the air to levels that are so high that people can asphyxiate, or suffocate.

What isn't very well known—and what I've done is to look at the medical literature and other sources; I can't find any health studies of the effects of methane at lower concentrations—what are the chronic effects of methane exposure at low levels, or *are* there any effects for low-level chronic exposure? Methane is a relatively stable gas, so it's not clear that there will be health effects in low concentrations, but we really don't know, and we need studies to evaluate that.

AHEARN: Now, let's talk a little bit about the fracking fluid. What's in there?

JACKSON: Well, fracking fluid is mostly water. It contains sand, ceramics, and other materials that prop the cracks open so when the water is pumped underground to crack or

fracture the rock, the sand flows in and keeps those cracks open when the pressure drops off.

But really the concern is about the other chemicals that are found. Some of these are organics—things like benzene, toluene, and xylene—that have known health risks if people are exposed to them in relatively low concentrations. There are a whole series of chemicals that are used to lower the friction, there are acids used to dissolve limestones and other things, and then materials that help the gas and liquids flow, and those are the chemicals that people are really concerned about.[5]

AHEARN: What do we know about where those chemicals go and how human beings may be exposed to them at some point down the line, or not?

JACKSON: Well, of course there are exposures to people who are working on the well pads. Each fracturing job takes 2 to 3 to 4 million gallons of fracking fluid per well, so there's a lot of this material that's used. Workers at the surface can be exposed to those chemicals either in mixing them or pumping them underground. In a sense, that's no different than any industrial facility where chemicals are being used.

But once they're pumped underground in millions of gallons, then several million gallons typically flow back to the surface as wastewater. So you have to dispose of that water. You have to capture that water. In some cases it can be pumped temporarily into an open pit or a pond, where it's exposed to the air. In other cases companies keep it entirely

locked away in tanks and things. But eventually you have to use trucks to take that water and ship it somewhere else.

AHEARN: Are these fracking-related pollutants getting into drinking water?

JACKSON: Well, that's a controversial question. The most recent case where that has been suggested and where the evidence seems to suggest that that's happened is in Wyoming—the Pavillion, Wyoming, case.[6] And there the Environmental Protection Agency has monitored drinking water and hydraulic fracturing sites beneath a series of homes, seeming to find the organics that are used in fracking fluids in those aquifers. Now, that result has been disputed by industry and by some groups, and it's still under debate and study today.

AHEARN: So, big picture: Have any actual human health effects been definitively linked to fracking?

JACKSON: Well, there have certainly been health risks associated with spills, with disposal issues, with leaks. Thousands of gallons of fracking fluids have leaked across people's properties. Workers have been exposed to these fluids. What isn't as clear, to me at least, is that the actual literal process of fracturing itself and the flowback of that wastewater has harmed human health. That's what's understudied today and is such a potential concern for people.

There are two kinds of wastewater that we're concerned about. It's not just the fracturing fluids that come back up from underground. There are also what are called "formation waters" or "produced waters." These are waters that have been underground for thousands of years. They can be radioactive, in the case of Pennsylvania. They're very salty, or briny. So another thing that we worry about is the water that flows back to the surface after the fracturing fluids have returned, over the course of many years. This water can be pretty nasty, and you can't just discharge that water into a stream or into a lake or into a river. It also has to be captured, just like a fracking fluid, and trucked away or disposed of properly. And if it's not disposed of properly, then that can be a problem, too.

AHEARN: We hear about communities across states like New York and Pennsylvania that are actively trying to prevent expansion of natural-gas drilling in their areas, and I'm wondering, what role do you think science plays in these kinds of community-level debates that are cropping up all over the East Coast?

JACKSON: Well, I think the goal of the science is to understand where problems occur and why and also where they don't occur. There are many wells that are drilled where there aren't any obvious health effects. In fact, most wells are that way. So really the science is about understanding the exceptions: When something goes wrong, why does it go wrong?

What small towns or communities choose to do with scientific information is their business. There are a number of cities and towns in the state of New York, in particular, who have proposed bans on shale-gas extraction, hydraulic fracturing. It's not clear to me that those bans will hold up legally. Generally, drilling is regulated at the state level, not at the level of towns or municipalities. There's going to be a long legal struggle surrounding those bans.

AHEARN: So you've got your work cut out for you, pretty much.

JACKSON: There's a lot of work to be done, both on the science but also on the human-health effects: stress, physical effects, all sorts of things. This field is going to be busy for a long, long time.

AHEARN: Dr. Jackson, thanks so much for joining me.

JACKSON: Thank you, Ashley.

AHEARN: Dr. Rob Jackson is a professor in the Nicholas School of the Environment at Duke University.

And that's *The Researcher's Perspective*. I'm Ashley Ahearn. Thanks for downloading!

Ashley Ahearn, host of *The Researcher's Perspective*, has been a producer and reporter for National Public Radio and an Annenberg Fellow at the University of Southern California specializing in science journalism.

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